REMARKS

The abstract and specification have been amended in order to correct grammatical and idiomatic errors contained therein. No new matter has been added.

Claims 1-4 have been amended in order to more particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Claim 5 has been withdrawn from consideration by the Examiner. Affirmation is made of Applicants' election with traverse to prosecute the invention of Group I, Claims 1-4. Newly presented Claims 6-10 are directed to preferred embodiments of the present invention. No new matter has been added. Favorable consideration is respectfully solicited.

Claims 1-3 have been rejected under 35 USC 102(b) as being anticipated by JP '171. Claims 1-4 have been rejected under 35 USC 103(a) as being unpatentable over Sircar. Applicants respectfully traverse these grounds of rejection and urge reconsideration in light of the following comments.

The presently claimed invention is directed to an aluminum alloy piping material for automotive tubes having excellent corrosion resistance and formability and which is an annealed material of an aluminum alloy comprising, in mass %, 0.3 to 1.5% manganese, 0.20% or less of copper, 0.10 to 0.20% of titanium, more than 0.20% but no greater than 0.60% of iron and 0.50% or less of silicon with the balance being aluminum and unavoidable impurities. The aluminum alloy piping material has an average crystal grain size of no greater than 100 microns and titanium-based compounds having a grain size of 10 microns or more do not exist as an aggregate of two or more serial compounds in a single crystal grain.

The aluminum alloy piping material of the present invention is especially suitable for use as an automotive tube for connecting an automotive radiator and heater or for a tube connecting an evaporator, condenser and compressor.

Conventional tubes used to connect an automotive radiator and heater or an evaporator, condenser and compressor are usually expanded at the tube end by bulge forming and have a rubber hose on the end thereof fastened by a metal band. Piping materials made of an aluminum-manganese alloy tend to have pitting corrosion or intergranular corrosion when used under severe conditions. Additionally, when a rubber hose is provided on an end thereof, crevice corrosion occurs underneath the rubber hose on the outer surface of the piping material. This can be prevented by the use of a clad pipe but results in a significant cost increase.

The present inventors have proposed the use of a piping material in which copper and titanium are added to an aluminum-manganese alloy and limiting the iron and silicon contents to specified content ranges so that the alloy has improved crevice corrosion resistance. However, this piping material also occasionally suffered from insufficient formability in the bulge forming of the tube end and encountered a problem relating to corrosion resistance when exposed to a severe corrosive environment.

The present invention overcomes the problems associated with the prior art by providing an aluminum alloy piping material which comprises, in mass %, 0.3 to 1.5% manganese, 0.20% or less of copper, 0.10 to 0.20% of titanium, more than 0.20% but no greater than 0.60% of iron, and 0.50% or less of silicon with the balance being aluminum and unavoidable impurities. The material has an average crystal grain size of 100 microns or less and titanium-based compounds having a grain size of 10 microns or more do not exist as an aggregate of two or more serial compounds in a single crystal grain. It is respectfully submitted that the prior art cited by the Examiner does not disclose the presently claimed invention.

JP '171 is discussed in the instant specification and discloses an aluminum alloy comprising, in mass %, 0.3 to 1.5% manganese, no more than 0.20% copper, 0.06 to 0.30% titanium, 0.01 to 0.20% iron, 0.01 to 0.20% silicon with the balance

being aluminum and unavoidable impurities. Of the silicon-based compounds, iron-based compounds and manganese-based compounds present in the matrix, the number of compounds having a diameter of 0.5 microns or more is 2×10^4 or less per square mm.

The presently claimed invention is patentably distinguishable over JP '171 in that the present claims require that greater than 0.20 mass % iron be present in the aluminum alloy. As discussed in the present specification, the present inventors have discovered that when the iron content is less than or equal to 0.20 mass % in the claimed alloy, a large grain size and poor bulge formability results. This is shown by Specimen No. 39 in Table 6 on page 16 of the present specification.

The Examiner states that JP '171 discloses a specific alloy within the claimed range, Example 48. However, Example 48 has a copper content of 0.35 mass % while the presently claimed invention limits the copper content to no greater than 0.20 mass %. As such, Example 48 does not even present a showing of prima facie obviousness under 35 USC 103 with respect to the currently claimed invention. As such, it is respectfully submitted that the presently claimed invention is patentably distinguishable over JP '171.

The Sircar reference discloses an aluminum-based alloy composition consisting essentially of not more than about 0.03% copper, between 0.1 and up to about 1.5% manganese, between about 0.03 and about 0.35% titanium, magnesium in an amount up to about 1.0%, less than 0.01% nickel, between 0.06 and about 1.0% zinc, zirconium in an amount of up to about 0.3%, amounts of iron and silicon up to about 0.50%, up to 0.20% chromium with the balance being aluminum and inevitable impurities. The manufacturing process of the aluminum alloy of Sircar is disclosed in Column 5, lines 13-20. There it is stated that an ingot having a thickness of 76.2 mm is hot-rolled to a thickness of 9.55 mm, which is a reduction of 87.9%, and then cold-worked. The reduction ratio of cold

working and total reduction ratio is not disclosed in this reference. The thickness of the product automotive tubes is 1 mm. This means that there is a reduction from 76.2 mm to 1 mm, which is a reduction percentage of 98.7%. The piping material of the present invention cannot be obtained by such a process. As such, it is respectfully submitted that the presently claimed invention clearly is patentably distinguishable over this reference also.

The Examiner is respectfully requested to reconsider the present application and to pass it to issue.

Respectfully submitted,

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